Amendments to the Specification

As the original specification did not include numbered paragraphs, reference will be made based on page and line numbers.

In the Title:

Please amend the title to read: A MULTI-GENERATOR SYSTEM FOR AN ULTRASONIC PROCESSING TANK.

On page 1, please delete lines 3-8 and insert the following:

The subject application is a continuation-in-part of commonly-owned and co-pending U.S. Patent Application Serial No. 09/370,302; which is a division of U.S. Patent Application Serial No. 09/097,374 (now U.S. Patent No. 6,016,821, granted January 25, 2000); which is a continuation of U.S. Patent Application Serial No.: 08/718,945 (now U.S. Patent No.: 5,834,781, granted November 10, 1998) and U.S. Provisional Application No.: 60/049,717).

At page 3, line 10:

hertz. "MHz" refers to megahertz and a frequency magnitude of one million hertz.

At page 8, line 28:

~~inlcuding:an~~ including: an ultrasonic generator; and a universal switching regulator (known to those skilled

At page 13, line 5:

58; ~~and~~

At page 13, after line 8, insert:

FIG. 62 shows a waveform of a sweeping frequency signal according to the invention.

At page 19, line 14:

from the transducer ~~150'~~ 150" and from the surface ~~151'~~ 152'.

At page 28, line 8:

counting the ~~sonoluminescene~~ sonoluminescence emissions over a 8.33 millisecond period and plotting this

At page 29, line 31:

day problems associated with separate designs made ~~from~~ for countries with differing power

At page 34, line 3:

reservoir ~~804~~ 806 that is evacuated to a pressure below atmospheric pressure during the cleaning

At page 35, line 6:

welded to the surface of the tank 908 (illustrated by weld joint ~~910~~ 927). When integrated, the

At page 40, line 18:

of the switching of network ~~2032~~ 2034. In other forms, the start time for the cycle of the switching

At page 42, line 13:

7 milliseconds	Remote relay #1 energizes starting the ~~1/4~~ 1/2 sec. timer #1

At page 43, line 9:

square flange AMP ~~GPC~~ CPC receptacle with arrangement 11-4 (AMP part number 206430-1)

At page 45, after line 4, insert:

In an ultrasonic or microsonic cleaning or processing liquid, it is known that a particular frequency or a set of closely spaced frequencies will resonate a certain size population of bubbles or voids within the liquid. A conventional sweeping frequency ultrasonic or microsonic cleaning or processing signal produces a particular frequency or a set of closely spaced frequencies followed by

the next particular frequency or set of closely spaced frequencies adjacent to the first particular frequency or set of closely spaced frequencies.

Unfortunately, cavitation efficiency suffers with this type of conventional sweeping frequency ultrasonic or microsonic cleaning or processing signal because the first particular frequency or set of closely spaced frequencies depletes members of that certain size population of bubbles or voids within the liquid leaving a smaller population for the second adjacent particular frequency or set of closely spaced frequencies to resonate.

There is shown in FIG. 62, a sweeping frequency drive signal 3100 that overcomes the above-described cavitation efficiency limitation of the prior art. When a certain size population of bubbles or voids within the liquid begins to be depleted causing a loss in cavitation efficiency, drive signal 3100 jumps, changes or rapidly sweeps to a non adjacent frequency within the bandwidth of the transducer array, such that the process continues with improved cavitation allowed by the new bubble population associated with this new non adjacent particular frequency or set of closely spaced frequencies.

In a preferred embodiment, drive signal 3100 can be maintained in the upper half of a bandwidth. The bandwidth is typically 10% of the center frequency (unless the system employs a special design / procedure, e.g., overlapping transducers frequency ranges). Therefore, for a center frequency at the high end of the microsonic frequency range (350 kHz), the bandwidth is typically 35 kHz. For 40 kHz ultrasonic transducers, the bandwidth is typically about 4 kHz. After a defined period of time (i.e., before cavitation efficiency suffers) at point 3102, the frequency is changed to a new frequency that is typically one half bandwidth lower than the current frequency. This change in frequency may occur by sweeping the frequency to the new lower frequency (not shown; wherein the sweep time is typically less than 25% of the defined period of time), or stepping the frequency to the new lower frequency, as shown in FIG. 62. The length of this "defined period of time" is dependent on the frequency, power density, sweep rate, type of chemistry and chemistry conditions such as temperature. "Defined periods of time" vary inversely with respect to frequency and span the range from ten microseconds to two milliseconds. At point 3104, this sweeping frequency continues from this new lower frequency. After the defined period of time (described above) at point 3106, the frequency jumps to a new higher frequency (point 3108) that is typically one half bandwidth higher than the current frequency.

While a one half bandwidth frequency jump is typical, other amounts are possible. For example, the frequency may be jumped by a much larger percentage of the bandwidth, e.g., to a frequency proximate the lower limit of the bandwidth, such as point 3109.

Further, while the system is described above as sweeping the frequency between points 3104 and 3106, other configurations are possible. For example, the frequency may be maintained constant (not shown) during the defined period of time. Alternatively, the frequency may be changed (between points 3104 and 3106) via one or more frequency steps (shown in phantom); or the set of closely spaced frequencies between points 3104 and 3106 may be random frequencies (not shown).

This frequency sweeping and frequency jumping continues until striking the lowest frequency in the bandwidth (at point 3110). At this point, the frequency jumps to the highest frequency in the bandwidth (to point 3112), and the sweeping and jumping process is repeated until the lowest frequency in the bandwidth is reached again (not shown). This high cavitation efficiency process is repeated and continued for the time needed in that particular bandwidth.

If a multiple generator system is driving a transducer array with a set of defined bandwidths (e.g., multiple harmonic bandwidths), then after the time needed in a particular bandwidth has elapsed, the drive signal from a different generator may produce a similar high cavitation efficiency signal in a different bandwidth.